Updates

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Cold QCD Meeting

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Recap/Review

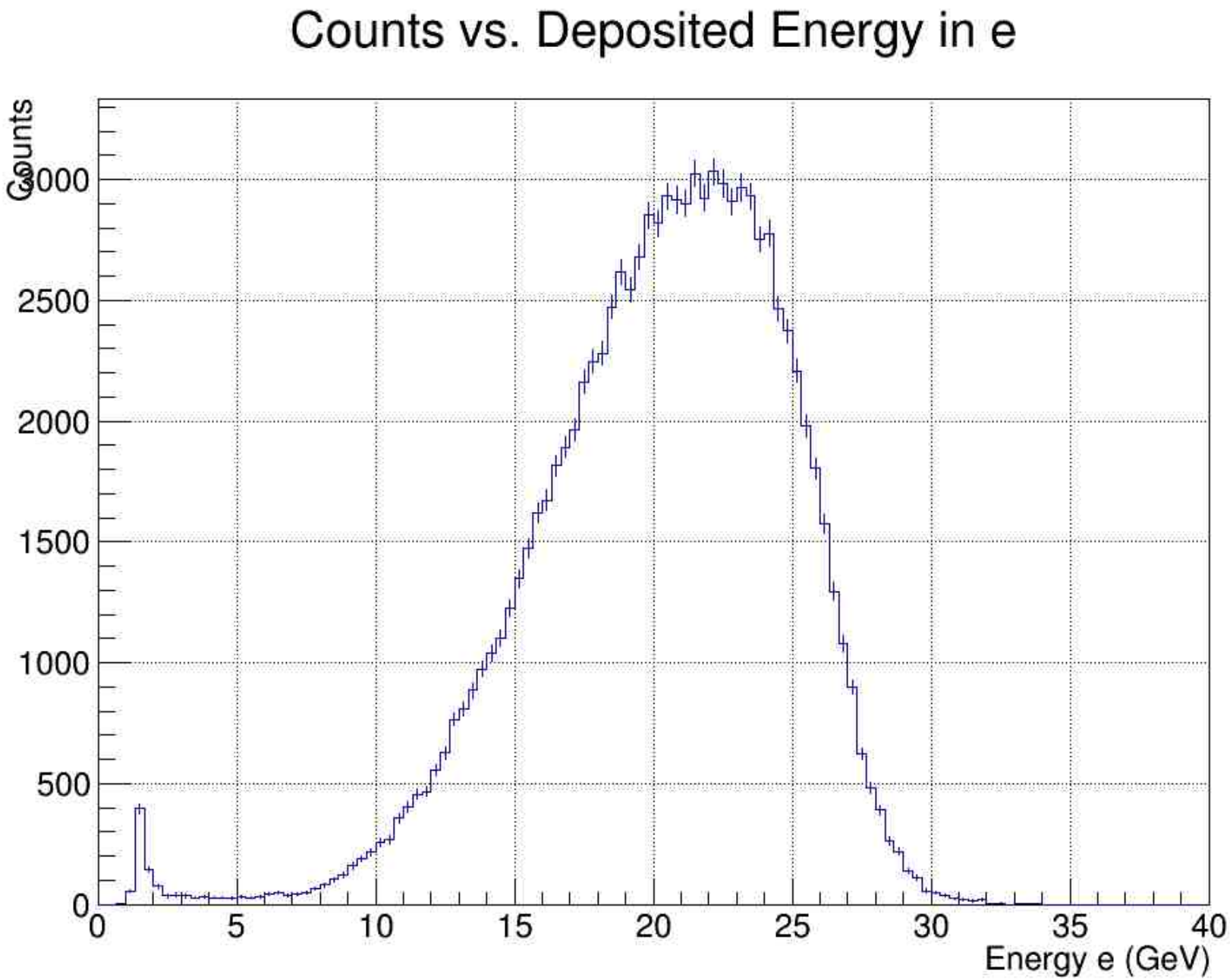
- Goal is to study how the flux return thickness will affect the energy resolution of the forward calorimeters
- Ran Simulations with 30 GeV pions(π^-) with $\eta = 2$.
- Collected 100,000 entries
- Started by looking only at histograms of the reconstructed energy from the calorimeters and tried some fits to this data
- The fits were non Gaussian at the thickness of interest (10.2 cm)
- Next step was to look at the energy deposited in flux return itself and/or other places the energy can go

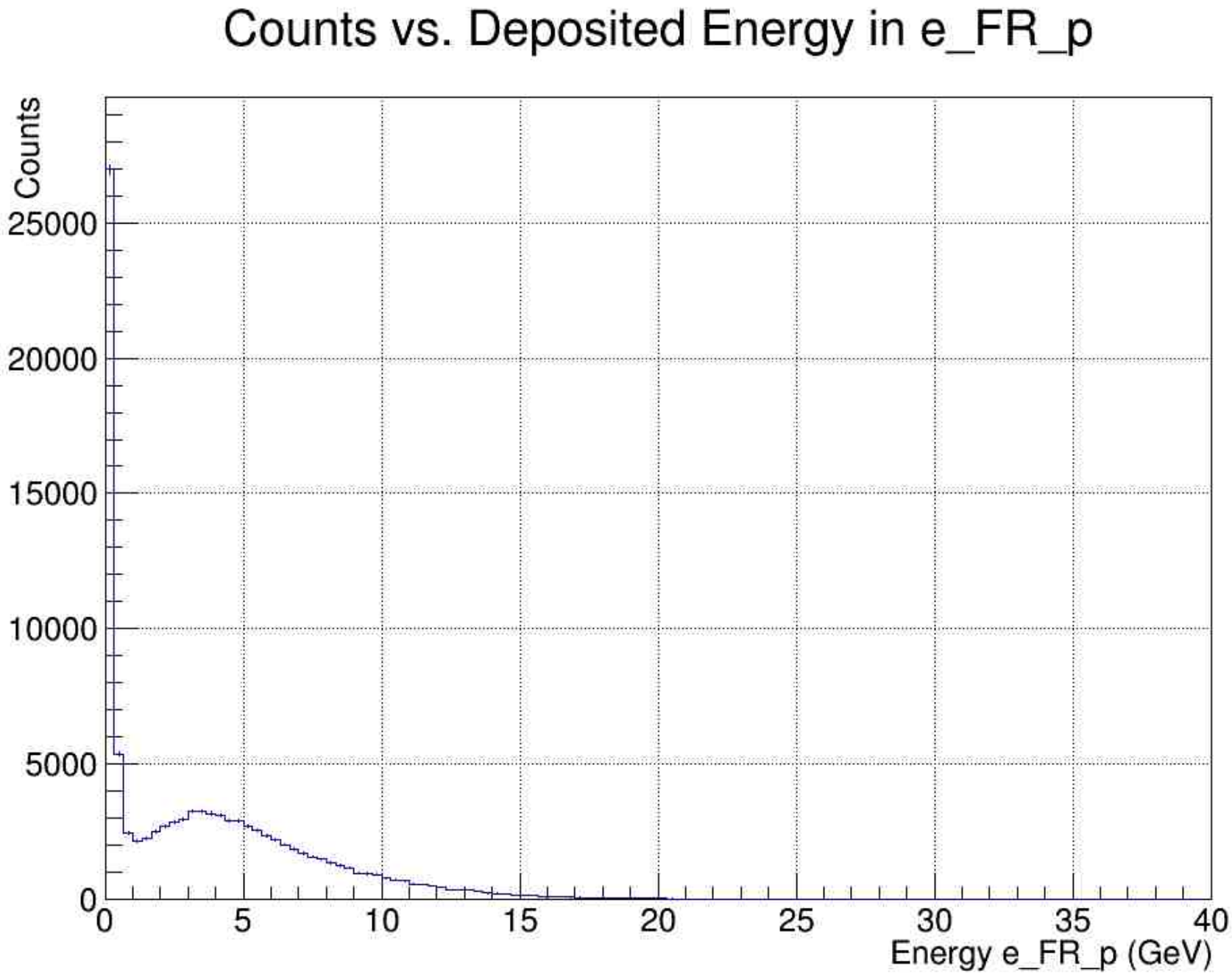
The Incorporated Energies from different sources in Flux Return Study

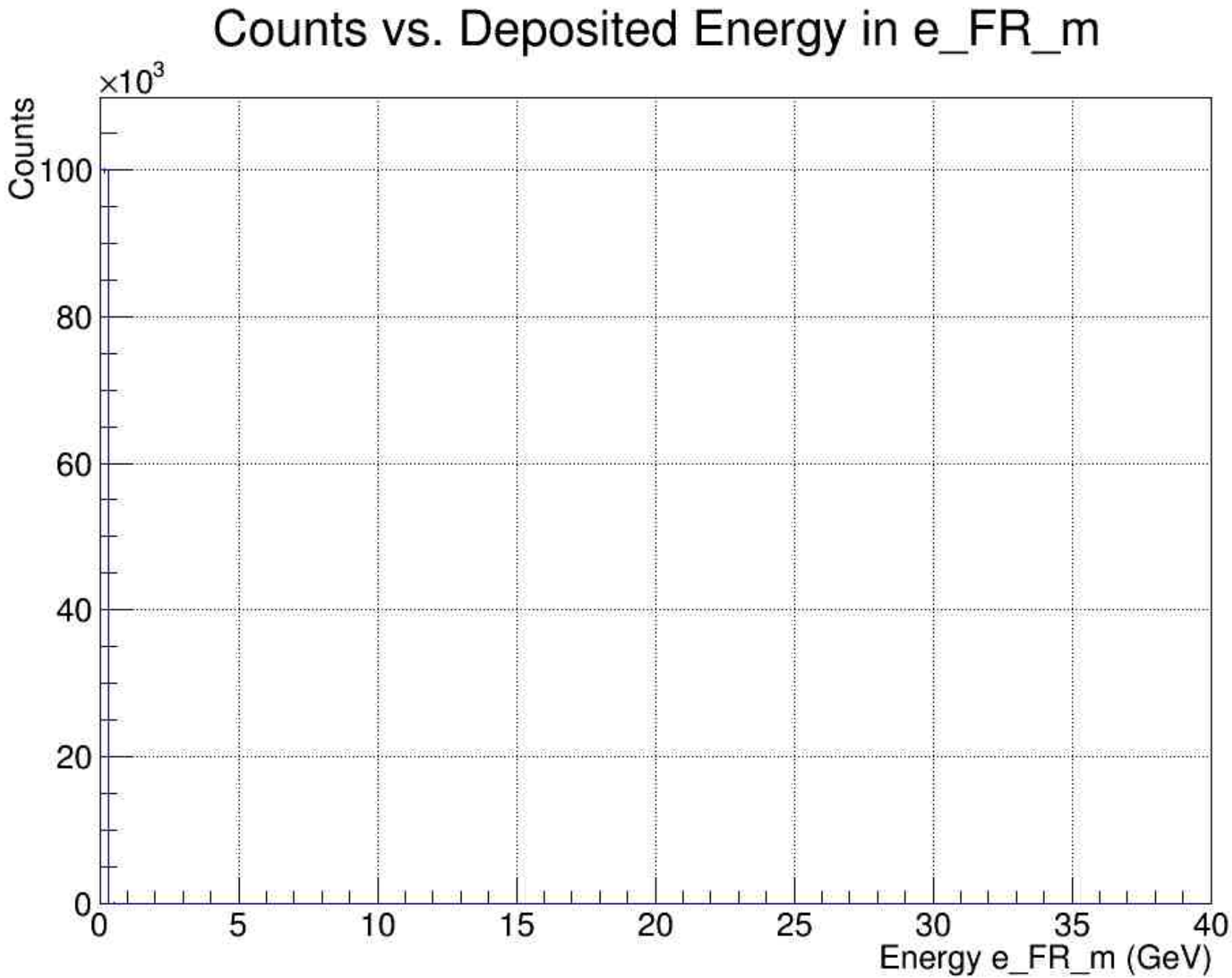
- Incorported the following energies
  - “e”: Energy absorbed by the Calorimeters
  - “e_FR_p”: Energy absorbed by the forward flux return, i.e. $\eta>0$
  - “e_FR_m”: Energy absorbed by the negative flux return, i.e $\eta<0$
  - “e_BH1”: Energy deposited in into the black hole in the $\eta=0$?
  - “e_BH_p”: Energy deposited into the black hole in the forward region
  - “e_BH_m”: Energy deposited into the black hole in the negative region
  - “e_sum”: Total energy from all 6 sources above
- Made plots of all seven energies for multiple thicknesses
- Plots can be found in the following slides

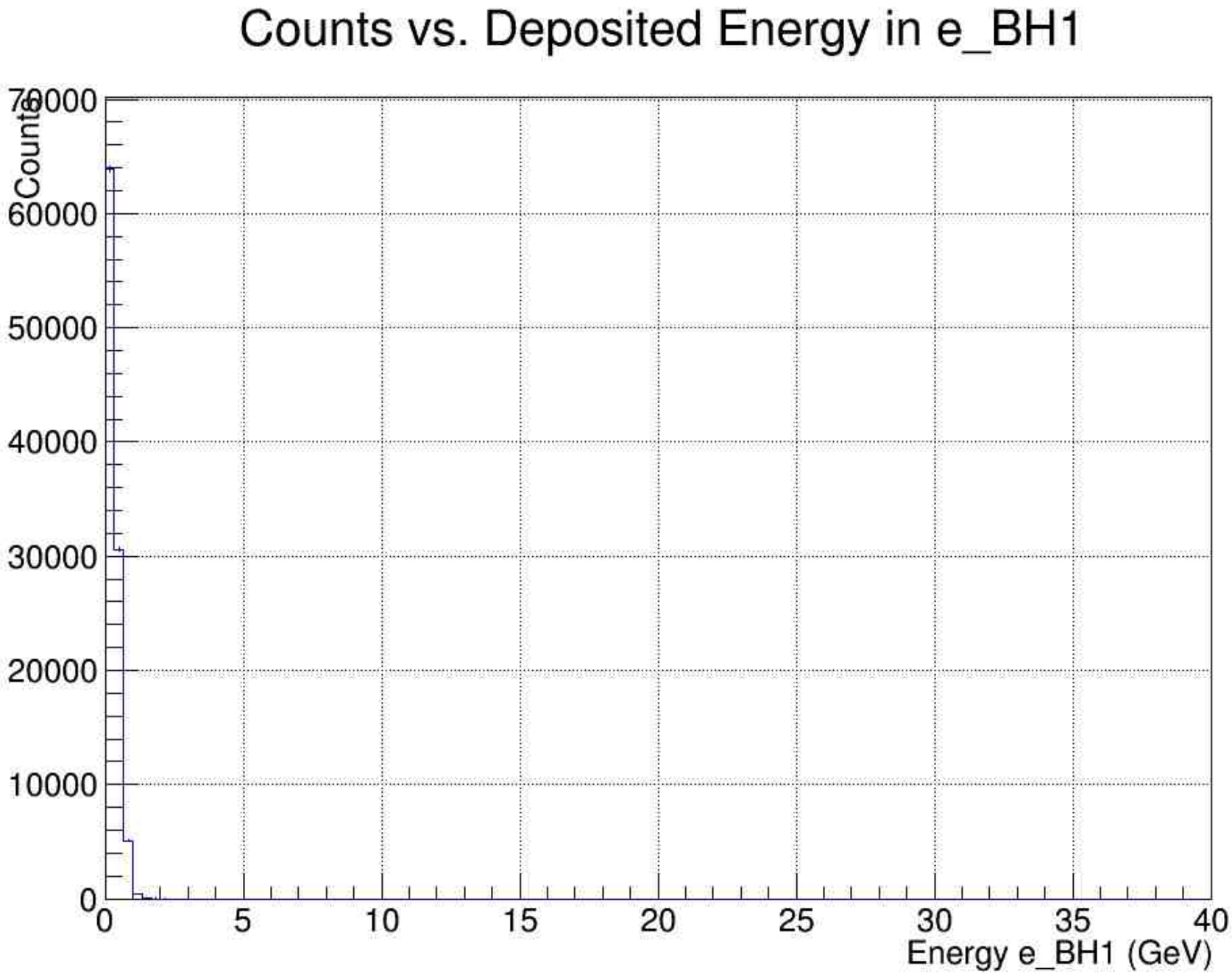
10.2 cm Thickness Plots

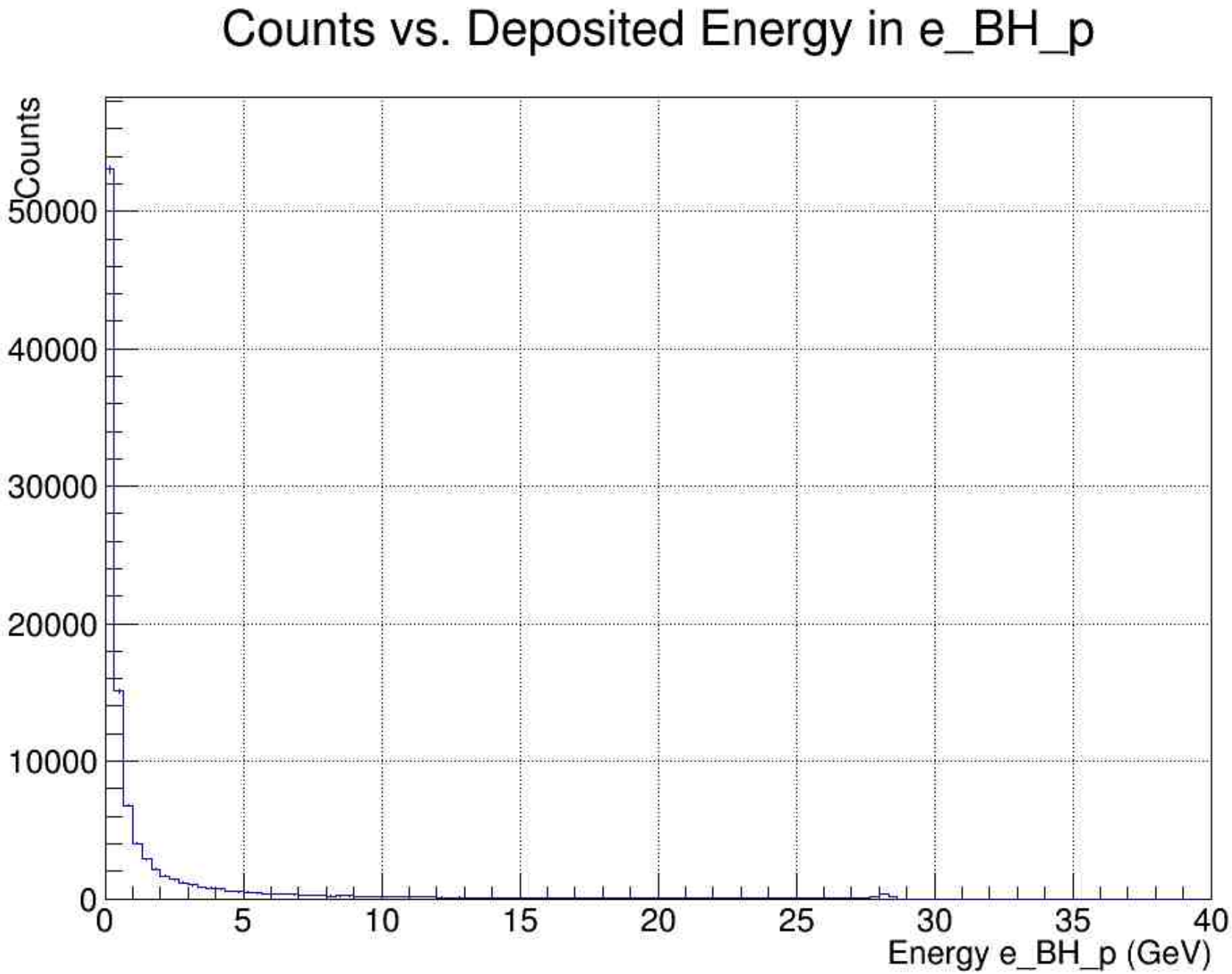
All histograms have 100,000 entries

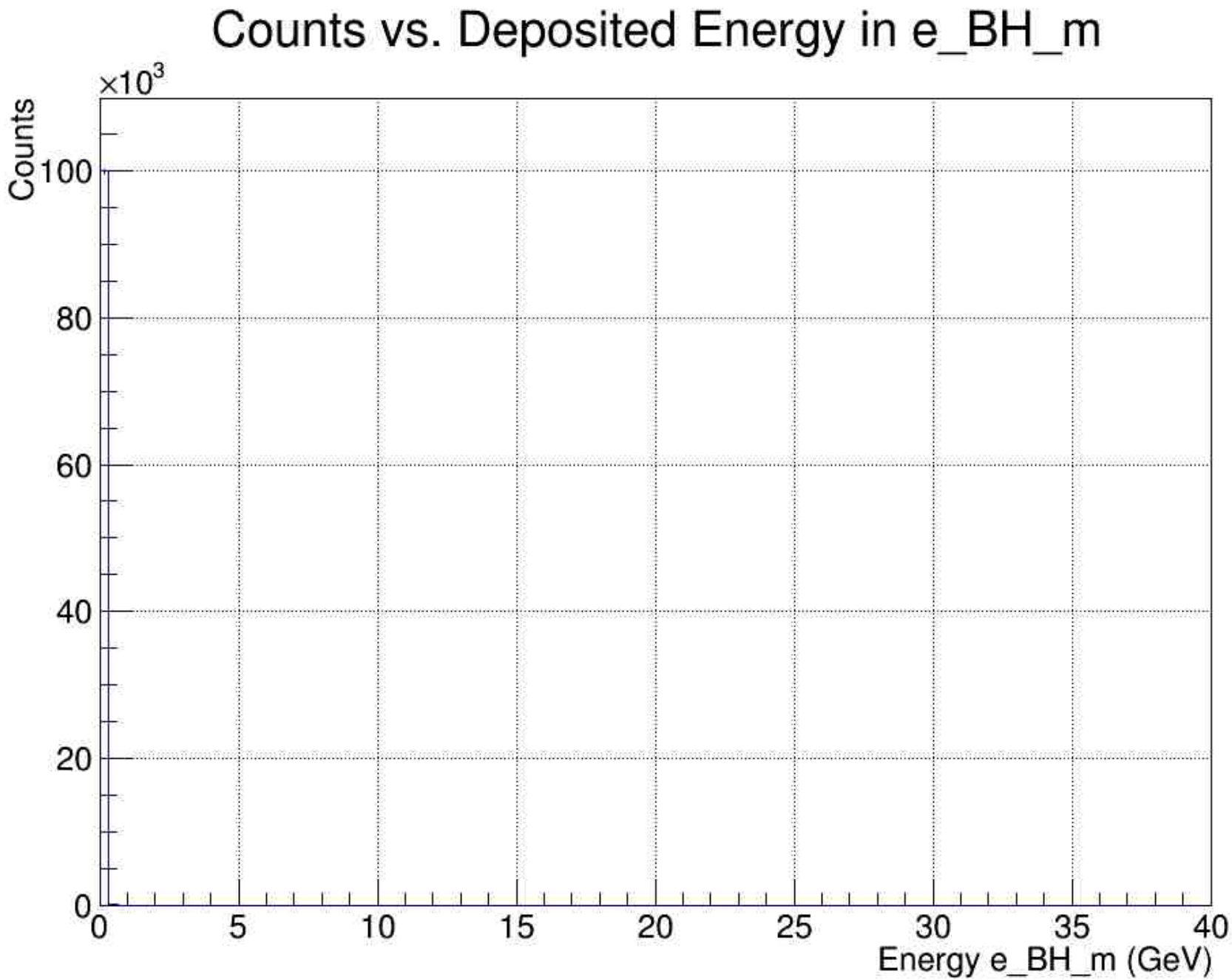

Counts vs. Deposited Energy in e
Counts
3000
2500
2000
1500
1000
500
0
0
5
10
15
20
25
30
35
40
Energy e (GeV)

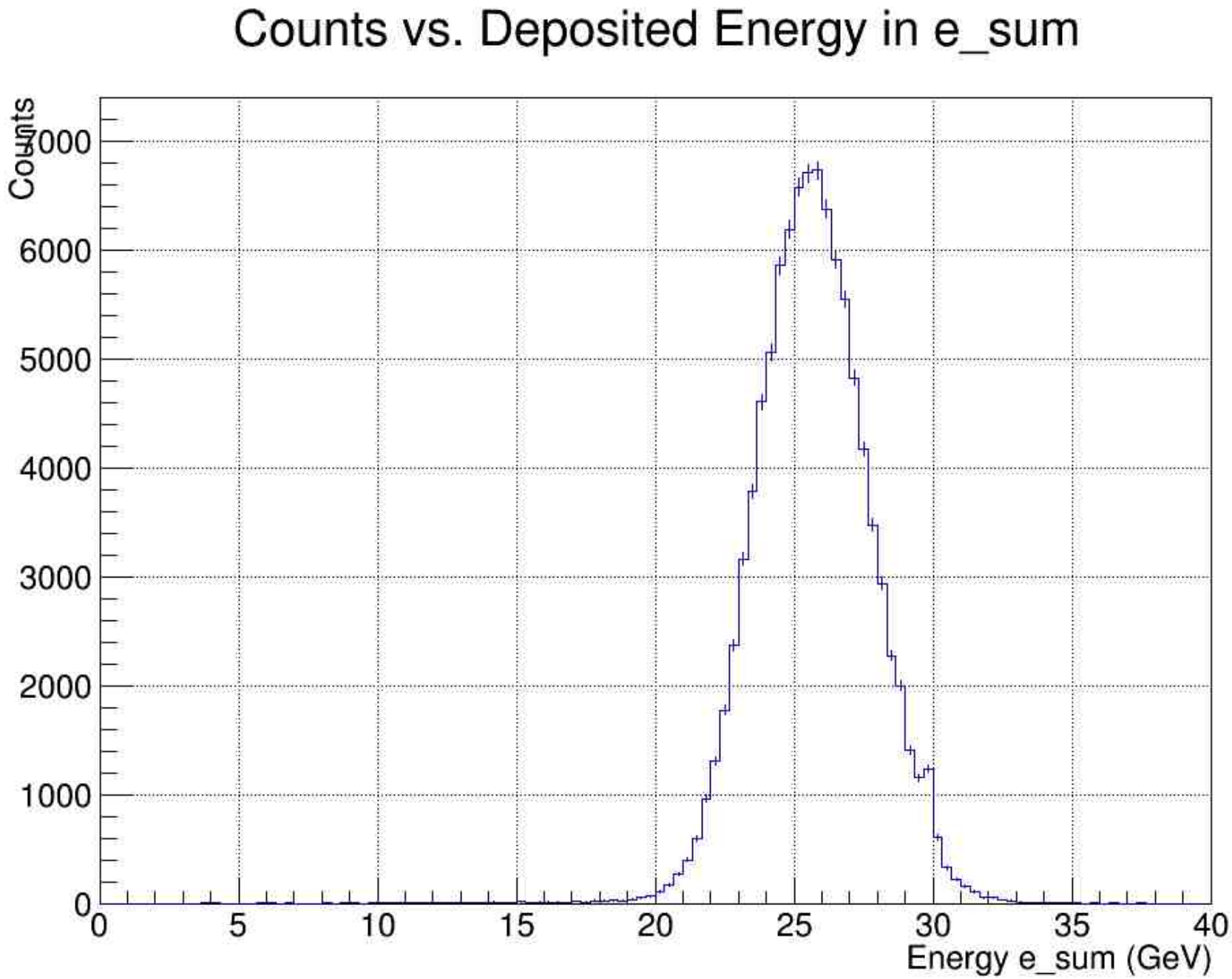

Counts vs. Deposited Energy in e_FR_p
Counts
25000
20000
15000
10000
5000
0
0
5
10
15
20
25
30
35
40
Energy e_FR_p (GeV)


Counts vs. Deposited Energy in e_FR_m
×10^3
Counts
100
80
60
40
20
0
0
5
10
15
20
25
30
35
40
Energy e_FR_m (GeV)


Counts vs. Deposited Energy in e_BH1
Counts
70000
60000
50000
40000
30000
20000
10000
0
0
5
10
15
20
25
30
35
40
Energy e_BH1 (GeV)


Counts vs. Deposited Energy in e_BH_p
Counts
50000
40000
30000
20000
10000
0
0
5
10
15
20
25
30
35
40
Energy e_BH_p (GeV)


Counts vs. Deposited Energy in e_BH_m
×10^3
Counts
100
80
60
40
20
0
0
5
10
15
20
25
30
35
40
Energy e_BH_m (GeV)

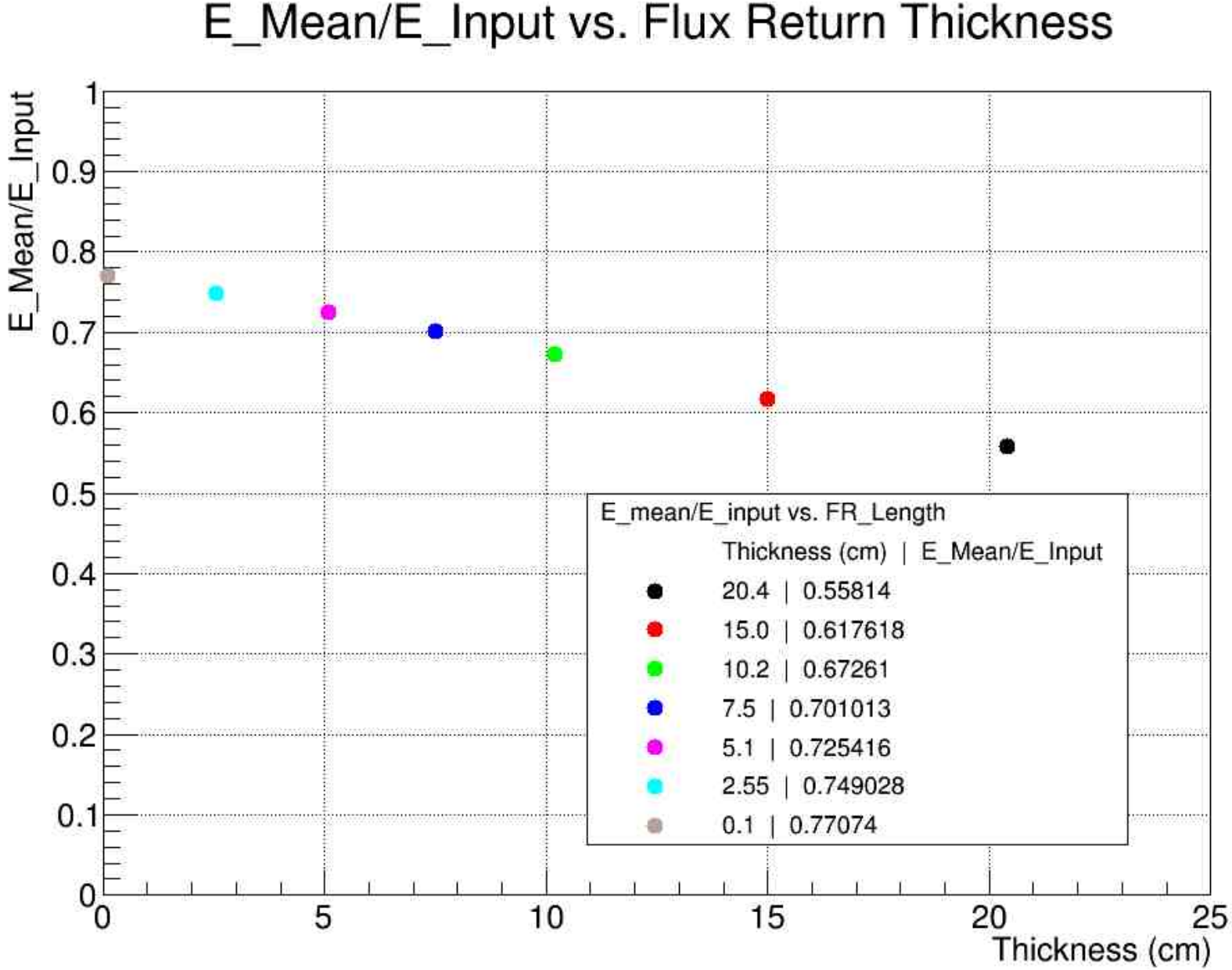

Counts vs. Deposited Energy in e_sum
Counts
7000
6000
5000
4000
3000
2000
1000
0
0
5
10
15
20
25
30
35
40
Energy e_sum (GeV)

Observations

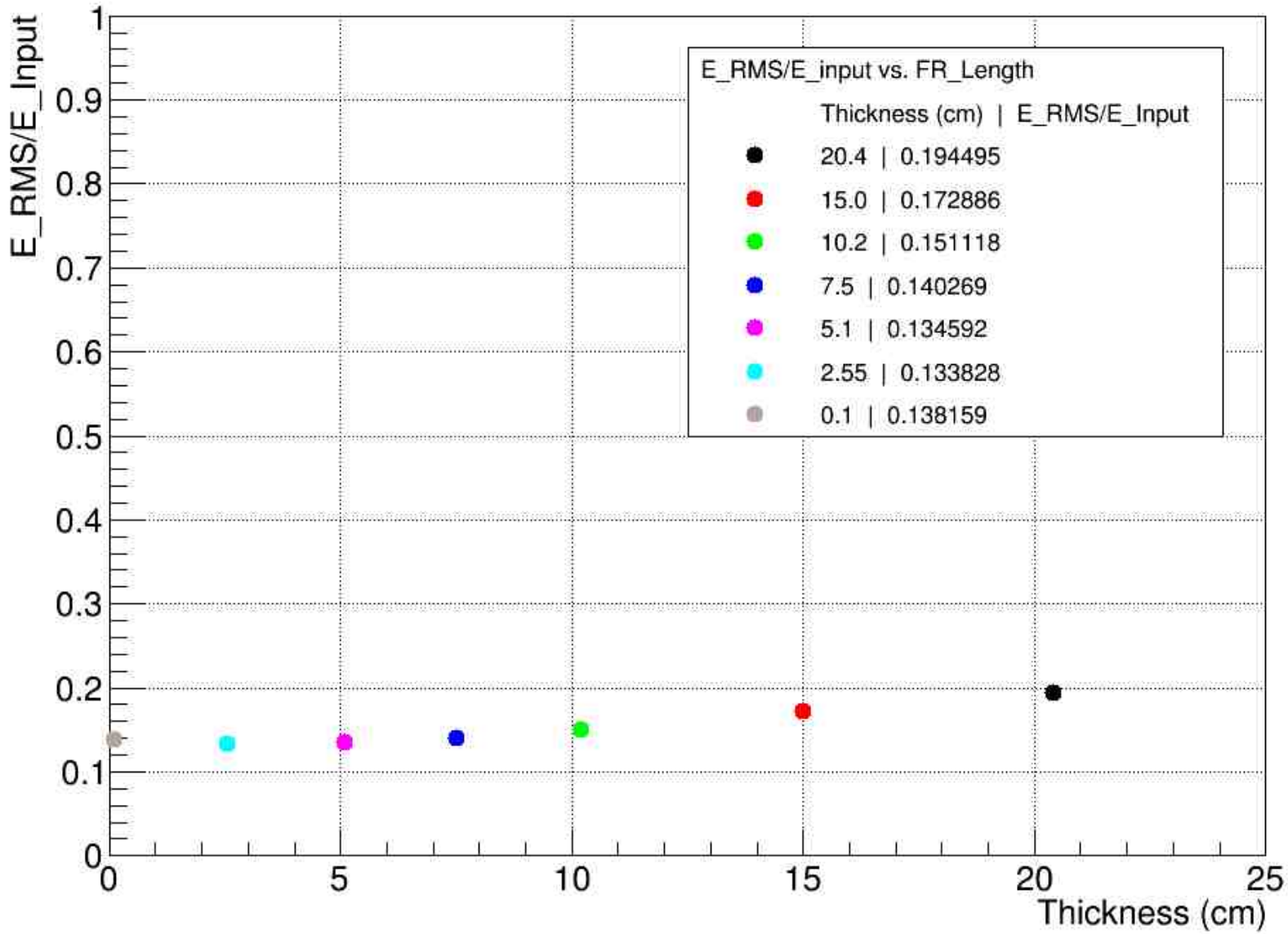
- Mostly behaving as expected
- The $\eta < 0$ is zero or almost zero as expected
- Black holes absorb very little energy compared to the Calorimeters and Flux Returns

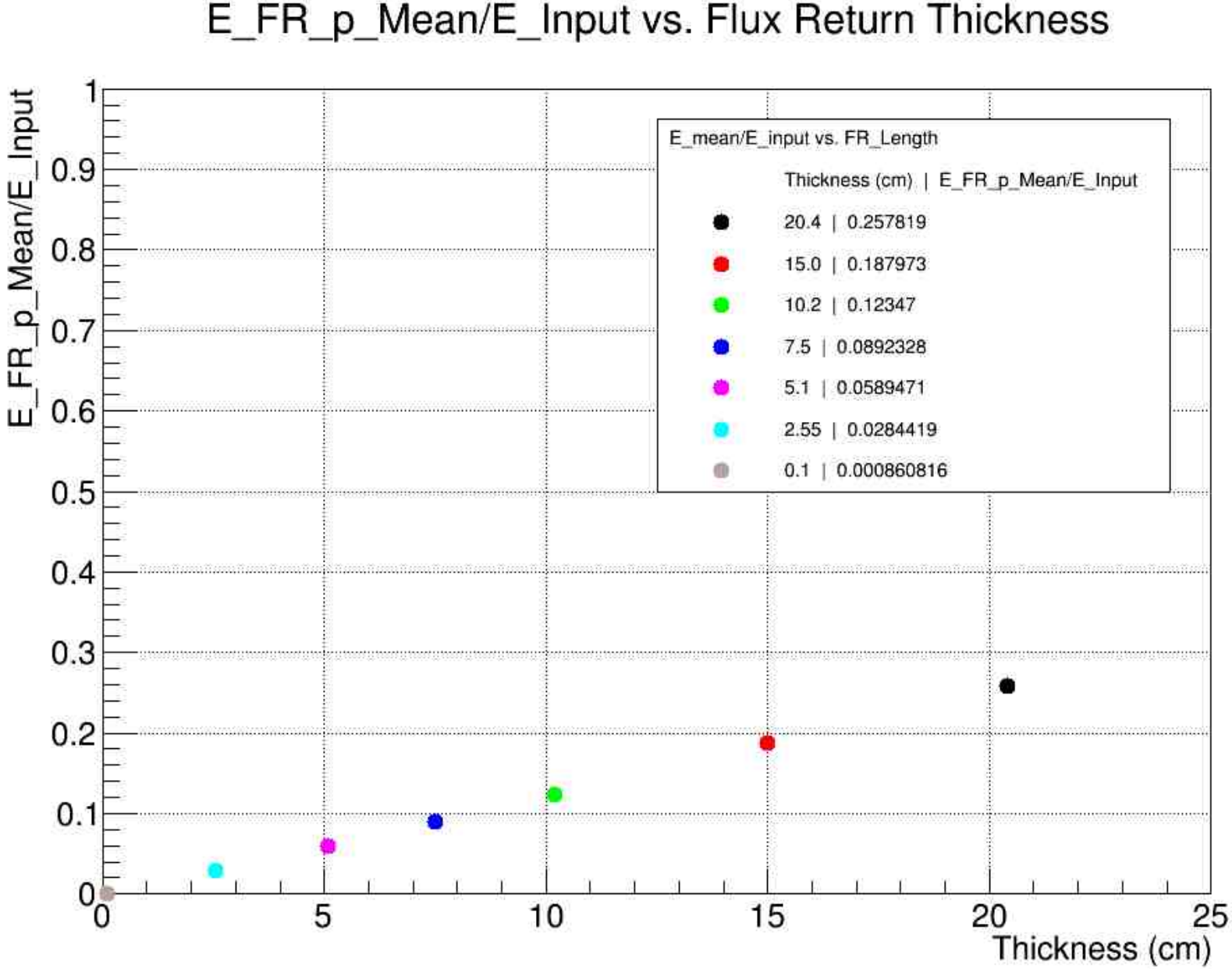
Using this result to Characterize the Flux Return

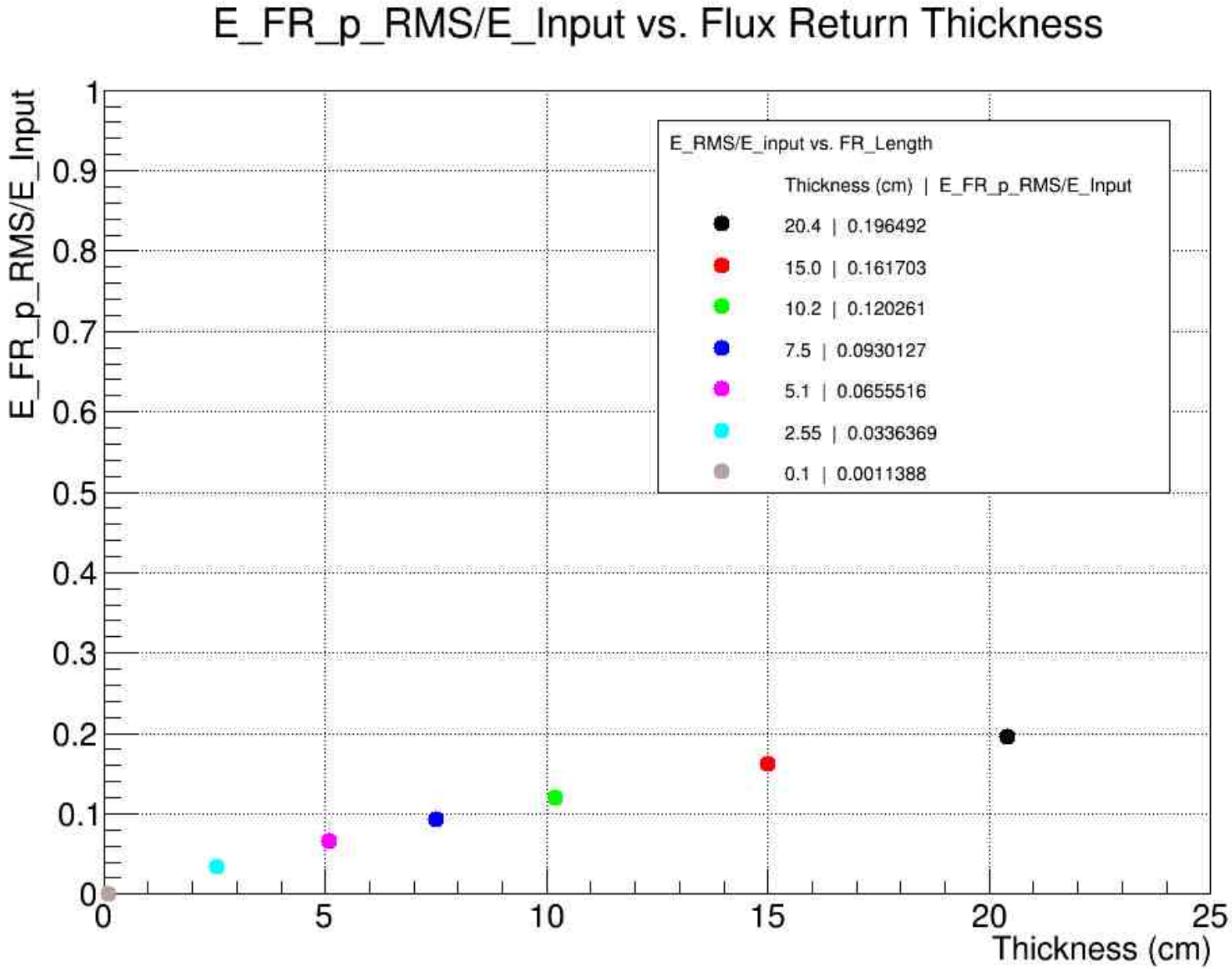
- Next step is to make plots of E/E_input vs. Flux Return Thickness
  - The E will be the mean of the histogram for the energies from the calorimeters, Flux Return, etc.
  - E_input will be the initial energy of the incoming pion
- Idea is to see whether the resolution of the Calorimeters exceed that of the Flux Return
- So far only did it for 30 GeV pions


E_Mean/E_Input vs. Flux Return Thickness
E_Mean/E_Input
Thickness (cm)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
5
10
15
20
25
E_mean/E_input vs. FR_Length
Thickness (cm) | E_Mean/E_Input
20.4 | 0.55814
15.0 | 0.617618
10.2 | 0.67261
7.5 | 0.701013
5.1 | 0.725416
2.55 | 0.749028
0.1 | 0.77074

E_RMS/E_Input vs. Flux Return Thickness




E_FR_p_Mean/E_Input vs. Flux Return Thickness
E_FR_p_Mean/E_Input
Thickness (cm)
E_mean/E_input vs. FR_Length
Thickness (cm) | E_FR_p_Mean/E_Input
20.4 | 0.257819
15.0 | 0.187973
10.2 | 0.12347
7.5 | 0.0892328
5.1 | 0.0589471
2.55 | 0.0284419
0.1 | 0.000860816
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
5
10
15
20
25


E_FR_p_RMS/E_Input vs. Flux Return Thickness
E_FR_p_RMS/E_Input
Thickness (cm)
E_RMS/E_input vs. FR_Length
Thickness (cm) | E_FR_p_RMS/E_Input
20.4 | 0.196492
15.0 | 0.161703
10.2 | 0.120261
7.5 | 0.0930127
5.1 | 0.0655516
2.55 | 0.0336369
0.1 | 0.0011388
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
5
10
15
20
25

Conclusions/Goals

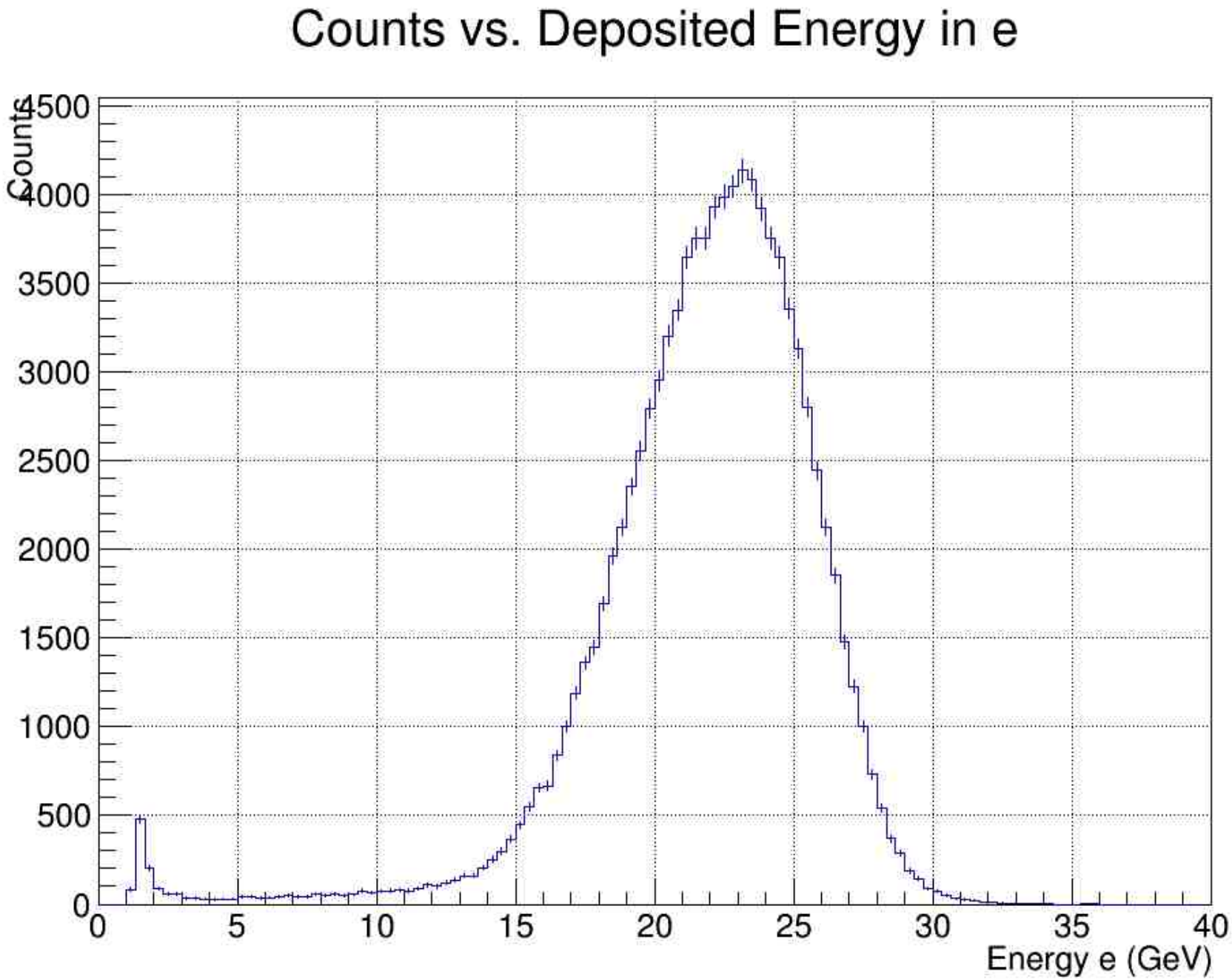
- Energies deposited in the various materials are behaving as expected
- The mean energy in the calorimeters are decreasing and the RMS is increasing with respect to thickness as expected
- The mean energy and RMS are increasing with thickness as expected since the more material the larger the amount of energy deposited
- Will continue to run simulations for pions at different energies.
- Begin to characterize these results to how how flux return is affecting the energy resolution

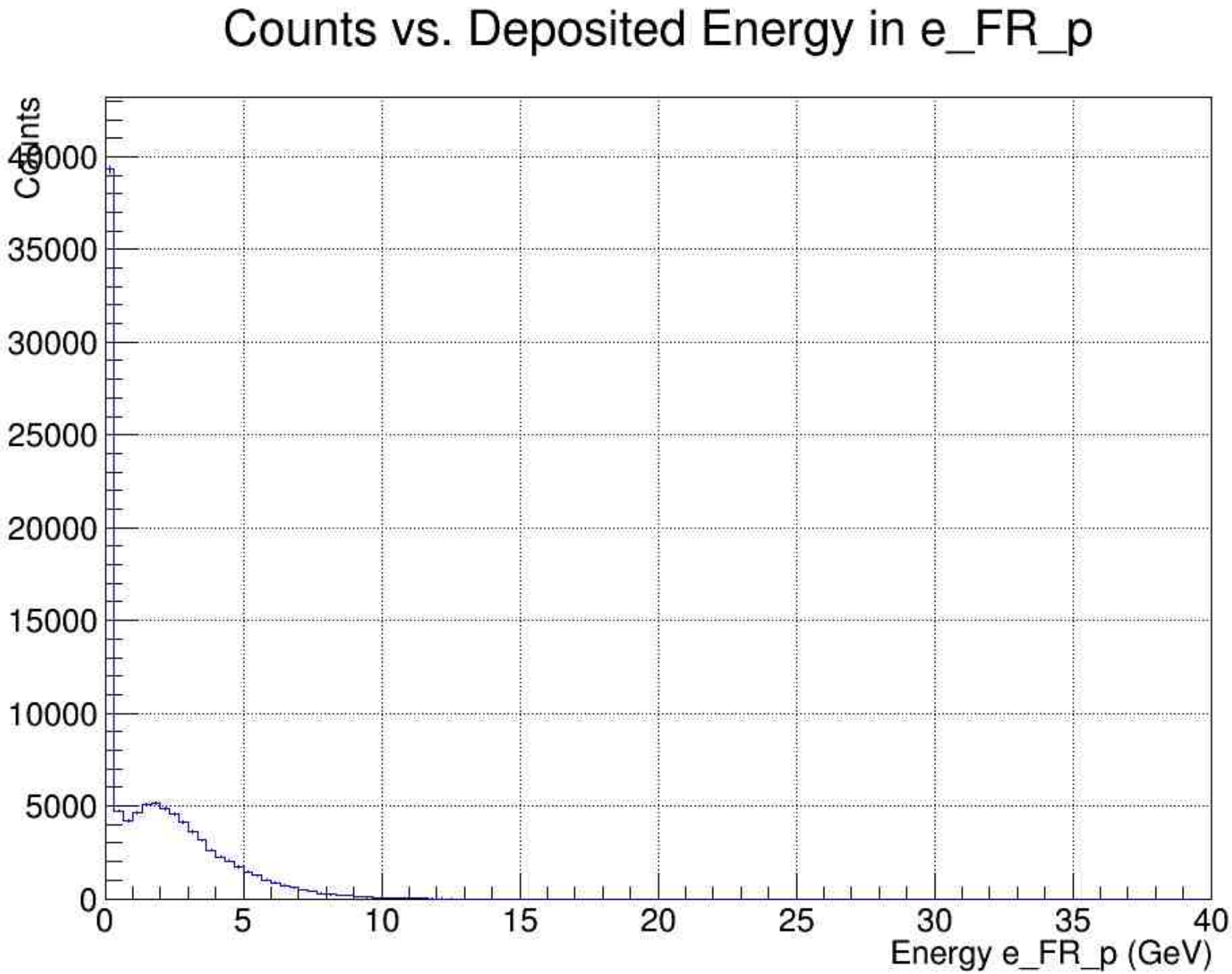
Backup Slides

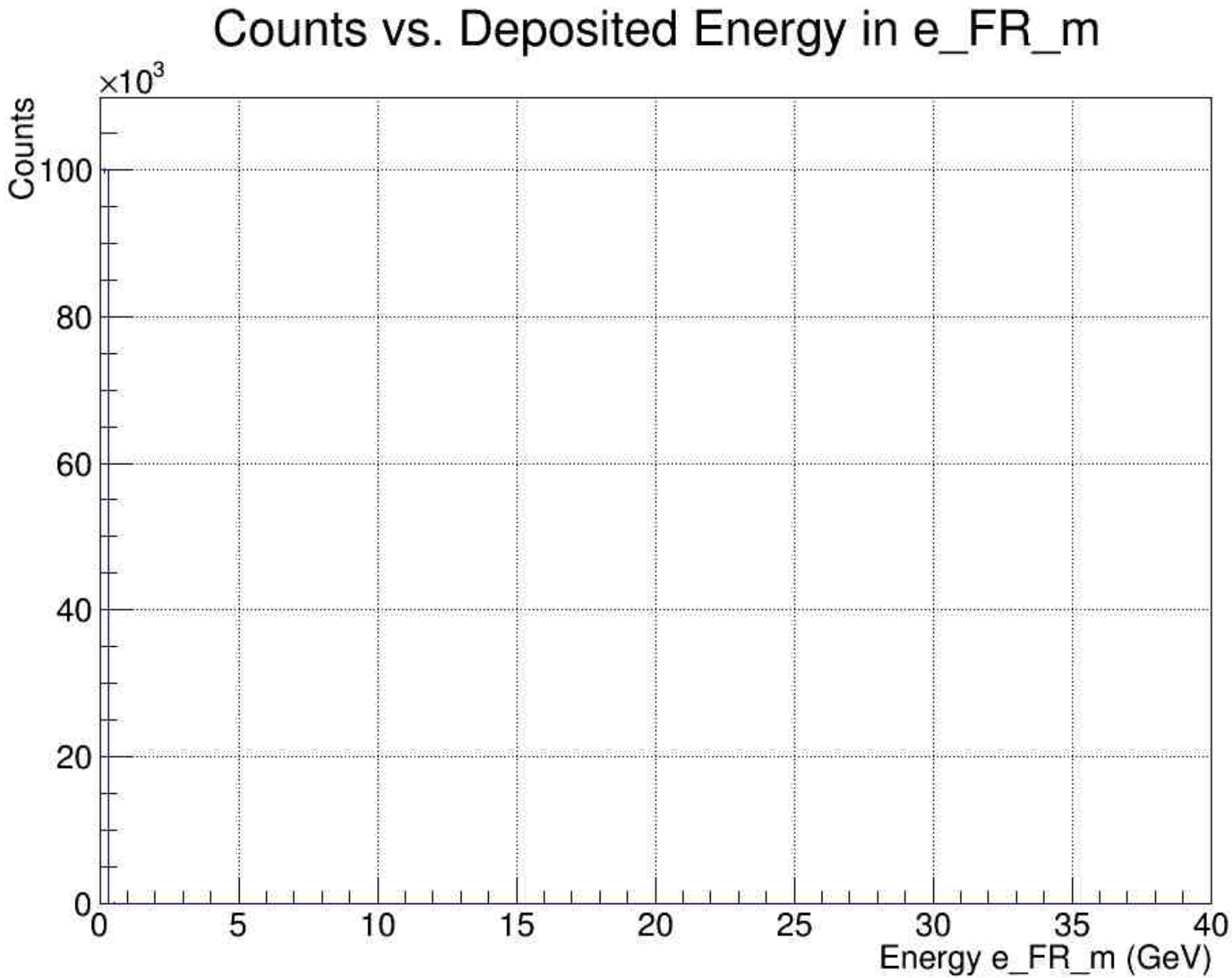
Contain the other thickness values

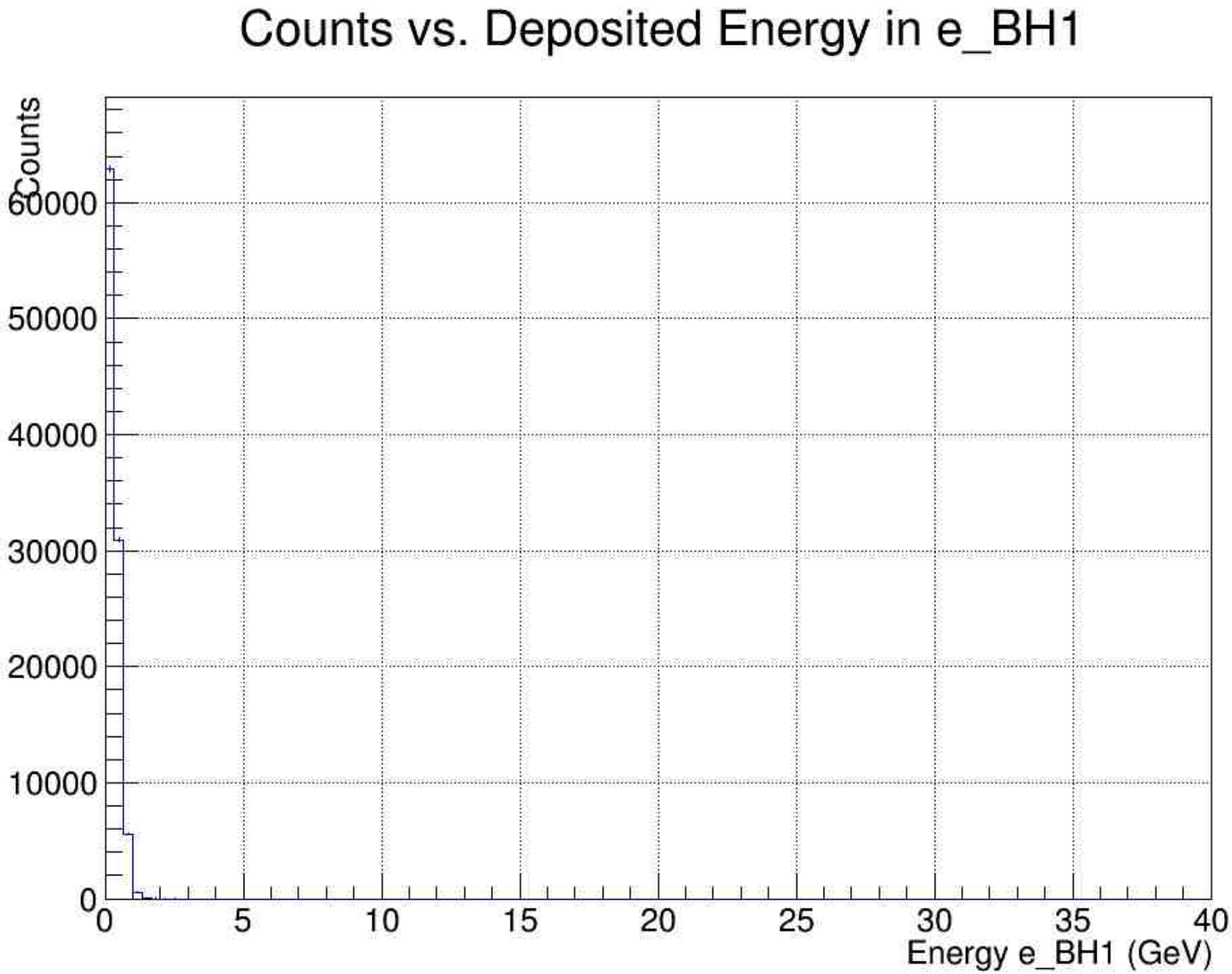
More can be requested if needed

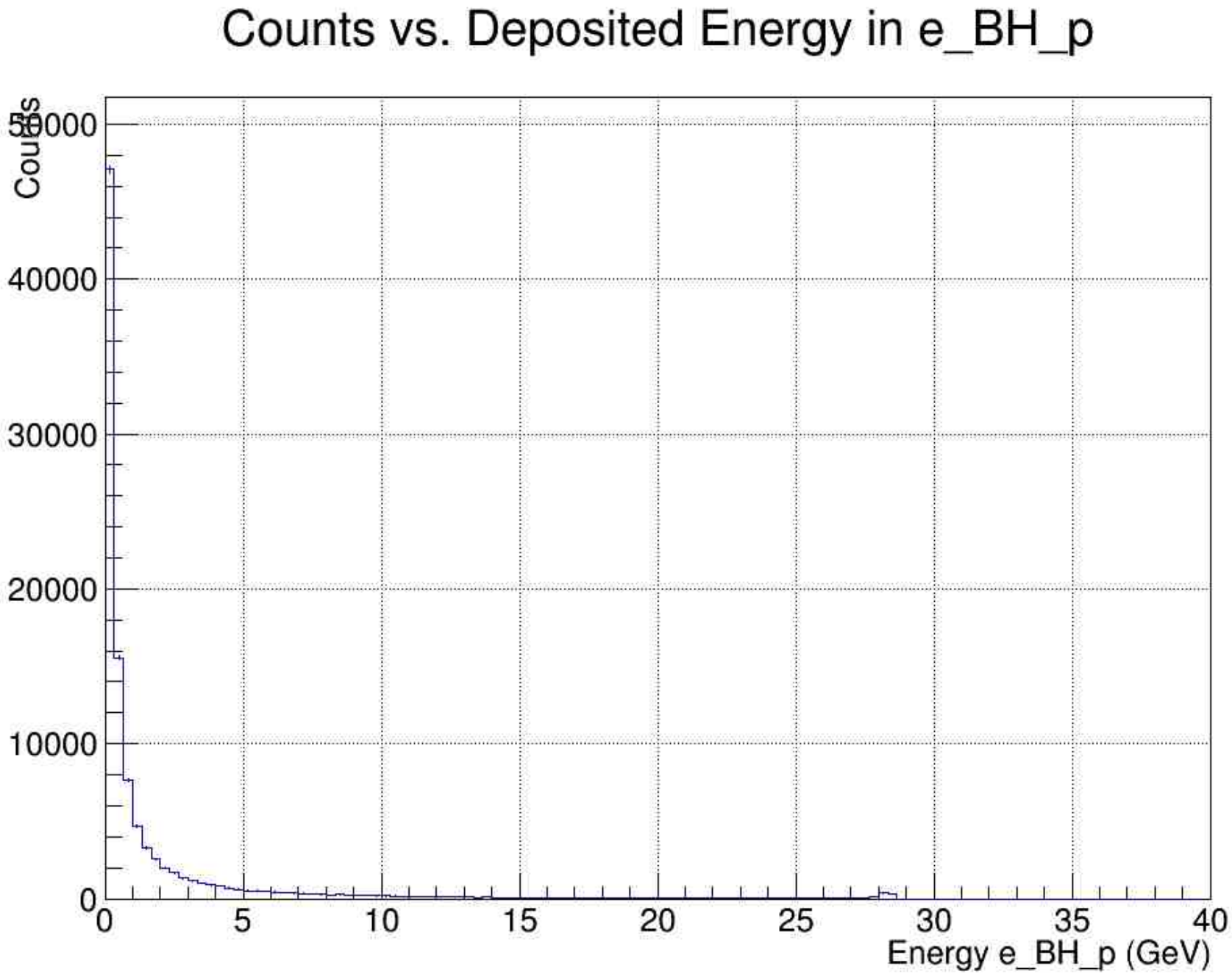
5.1 cm Thickness

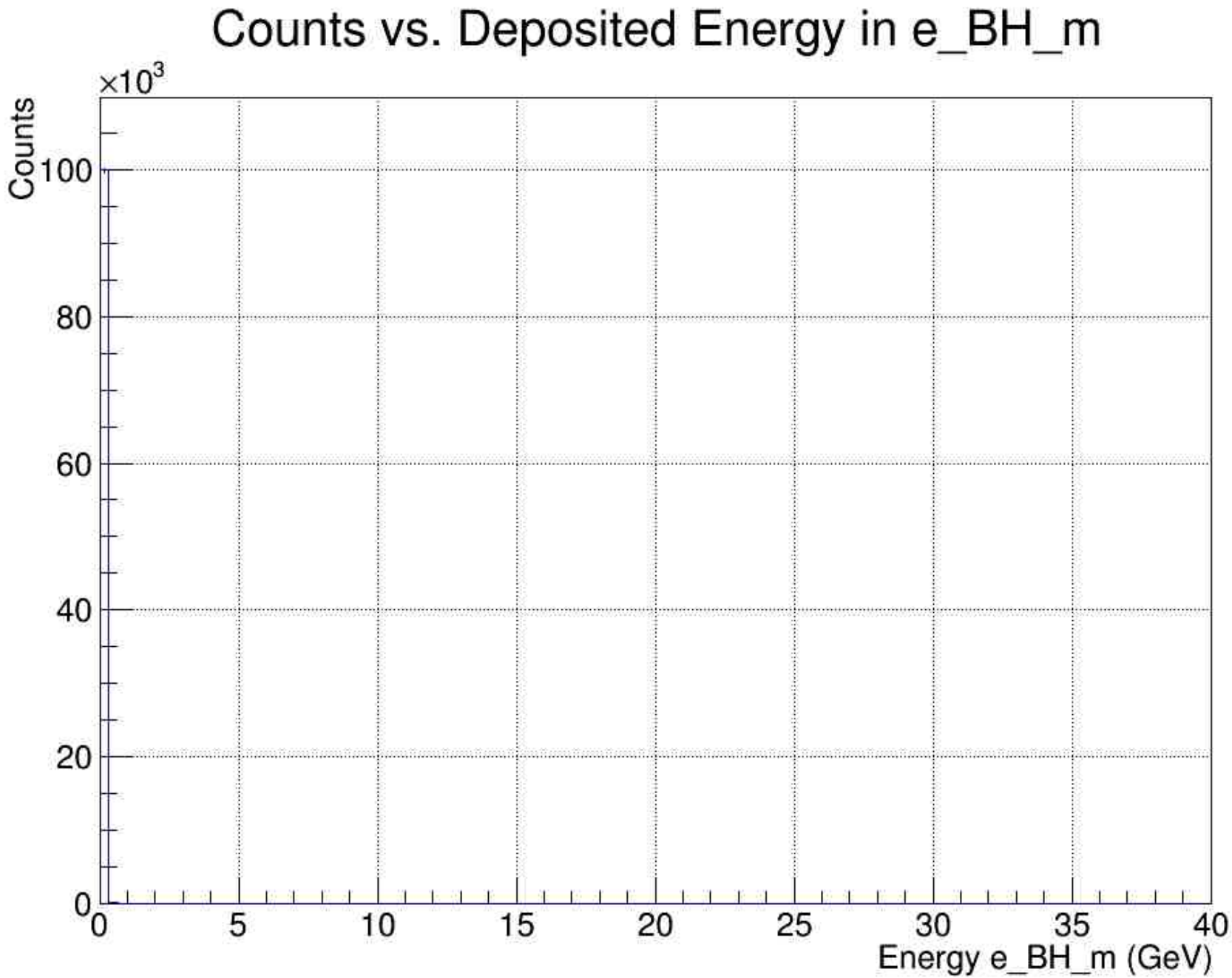

Counts vs. Deposited Energy in e
Counts
4500
4000
3500
3000
2500
2000
1500
1000
500
0
0
5
10
15
20
25
30
35
40
Energy e (GeV)

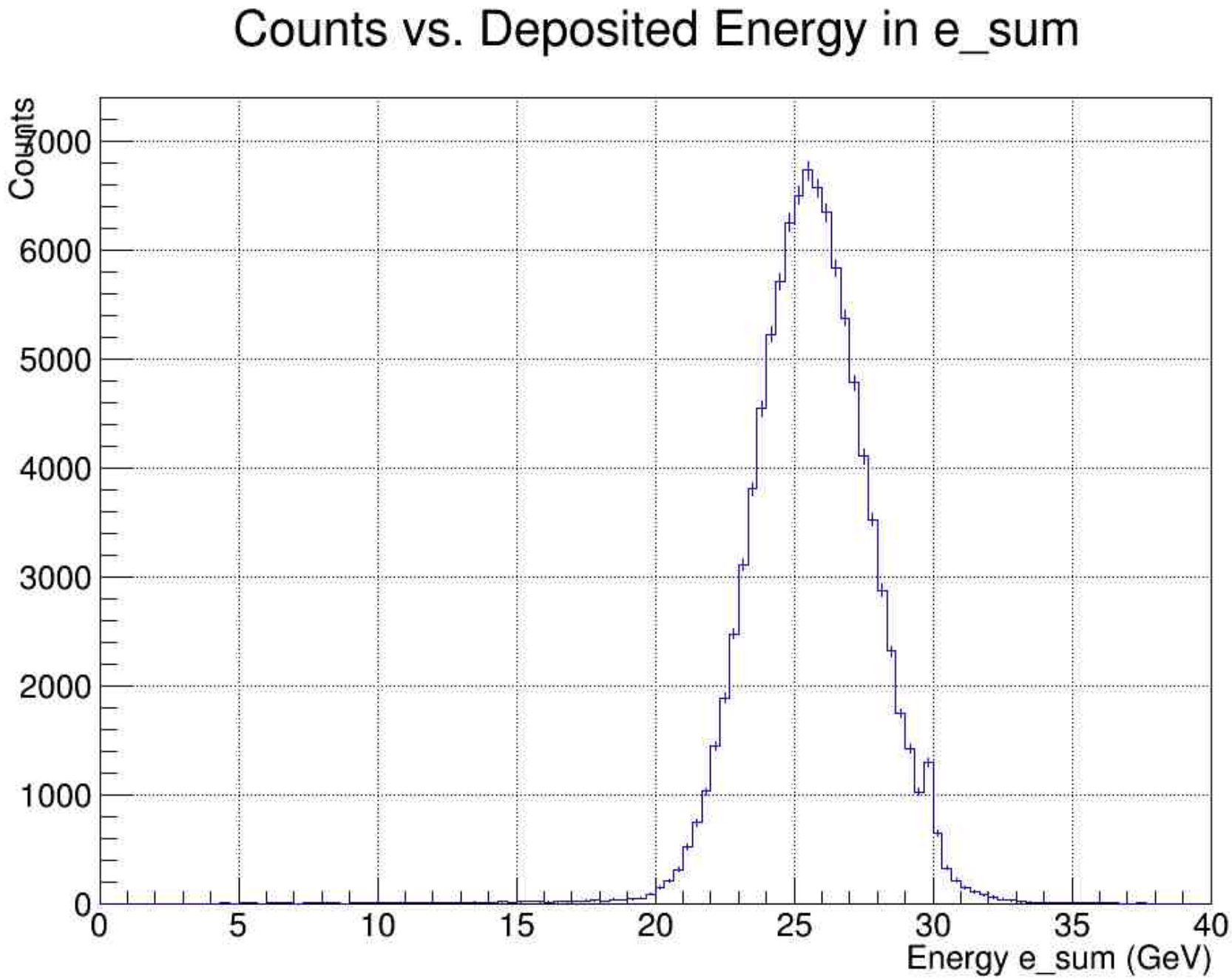

Counts vs. Deposited Energy in e_FR_p
Counts
40000
35000
30000
25000
20000
15000
10000
5000
0
0
5
10
15
20
25
30
35
40
Energy e_FR_p (GeV)


Counts vs. Deposited Energy in e_FR_m
×10^3
Counts
100
80
60
40
20
0
0
5
10
15
20
25
30
35
40
Energy e_FR_m (GeV)

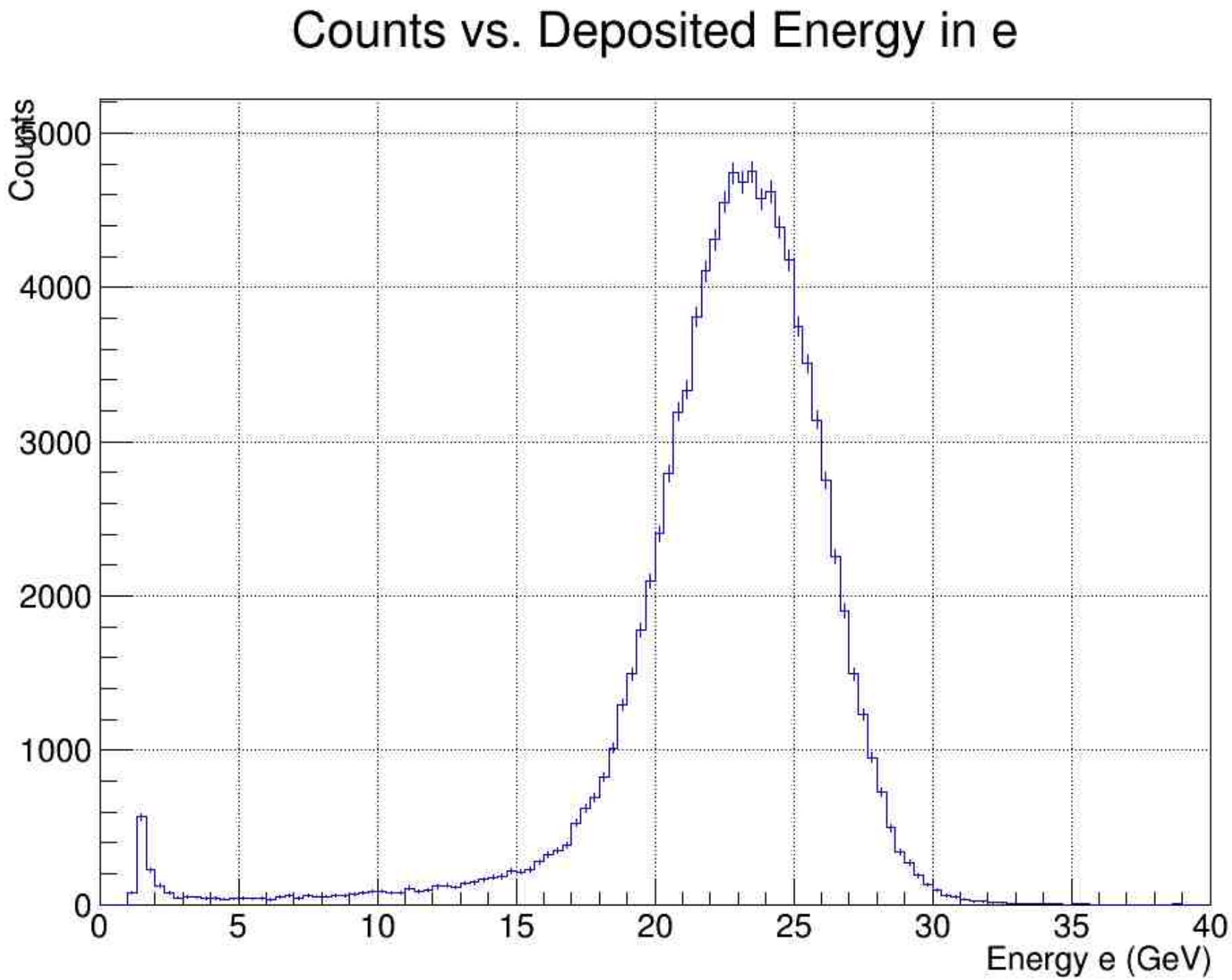

Counts vs. Deposited Energy in e_BH1
Counts
60000
50000
40000
30000
20000
10000
0
0
5
10
15
20
25
30
35
40
Energy e_BH1 (GeV)

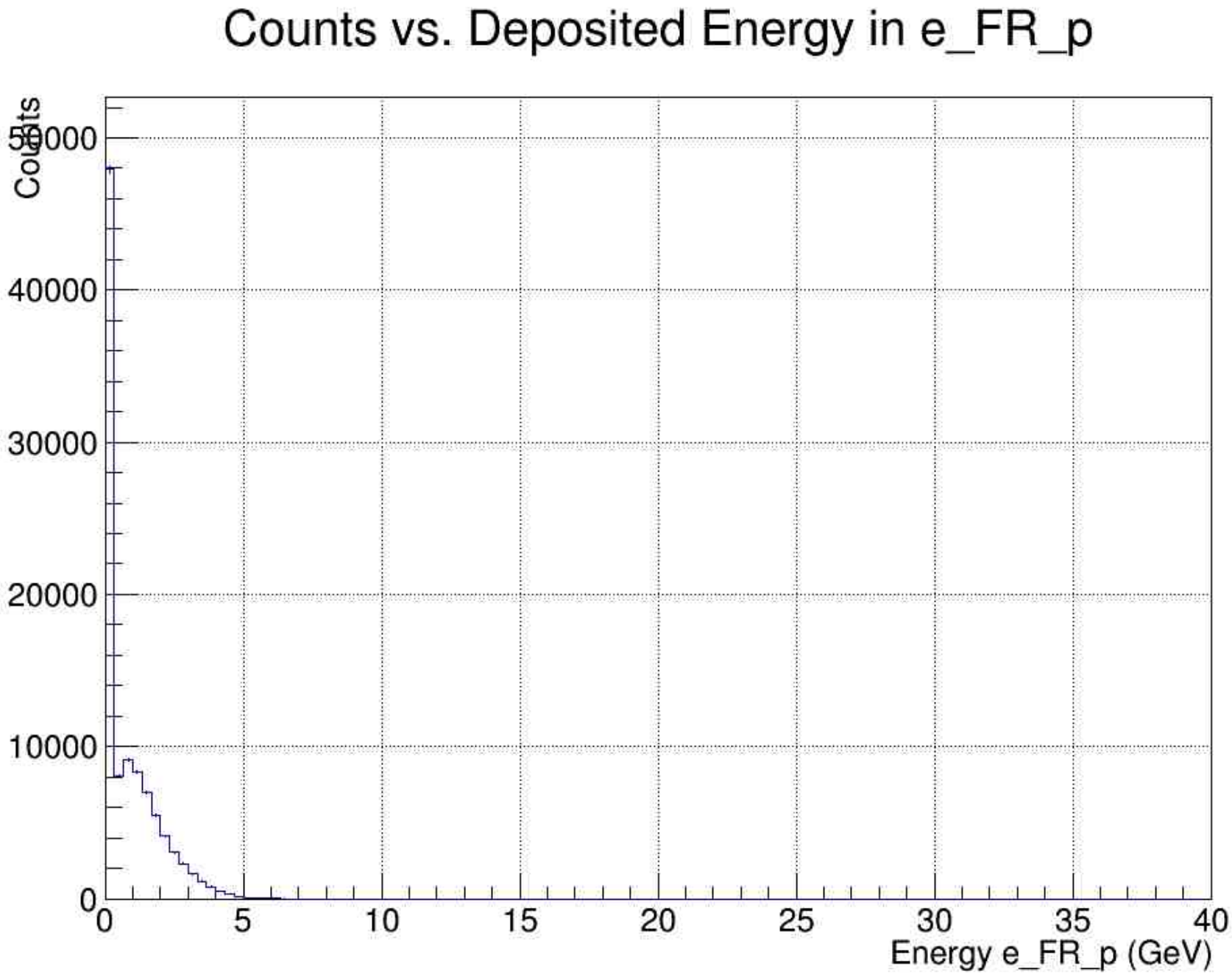

Counts vs. Deposited Energy in e_BH_p
Counts
50000
40000
30000
20000
10000
0
0
5
10
15
20
25
30
35
40
Energy e_BH_p (GeV)

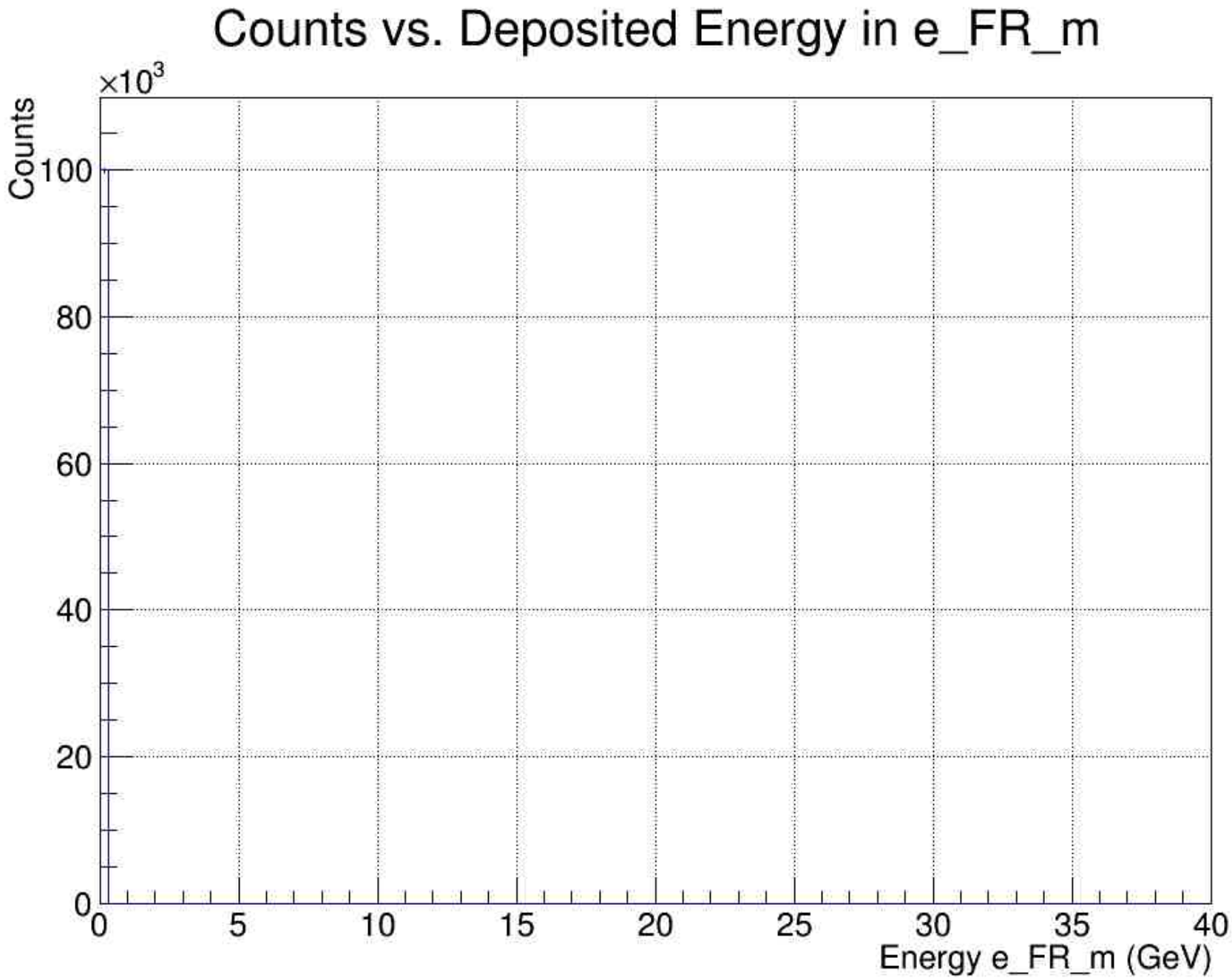

Counts vs. Deposited Energy in e_BH_m
×10^3
Counts
100
80
60
40
20
0
0
5
10
15
20
25
30
35
40
Energy e_BH_m (GeV)

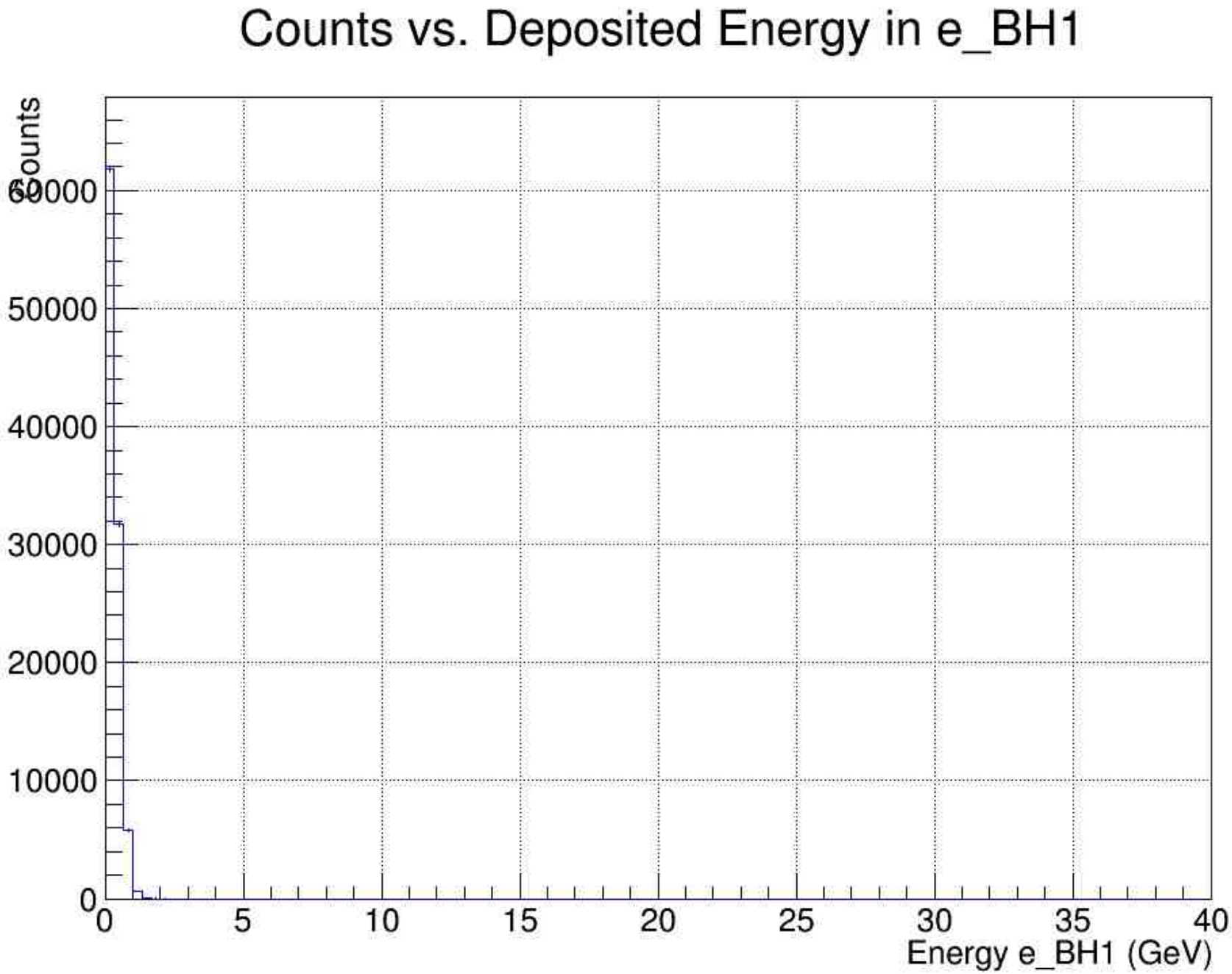

Counts vs. Deposited Energy in e_sum
Counts
7000
6000
5000
4000
3000
2000
1000
0
0
5
10
15
20
25
30
35
40
Energy e_sum (GeV)

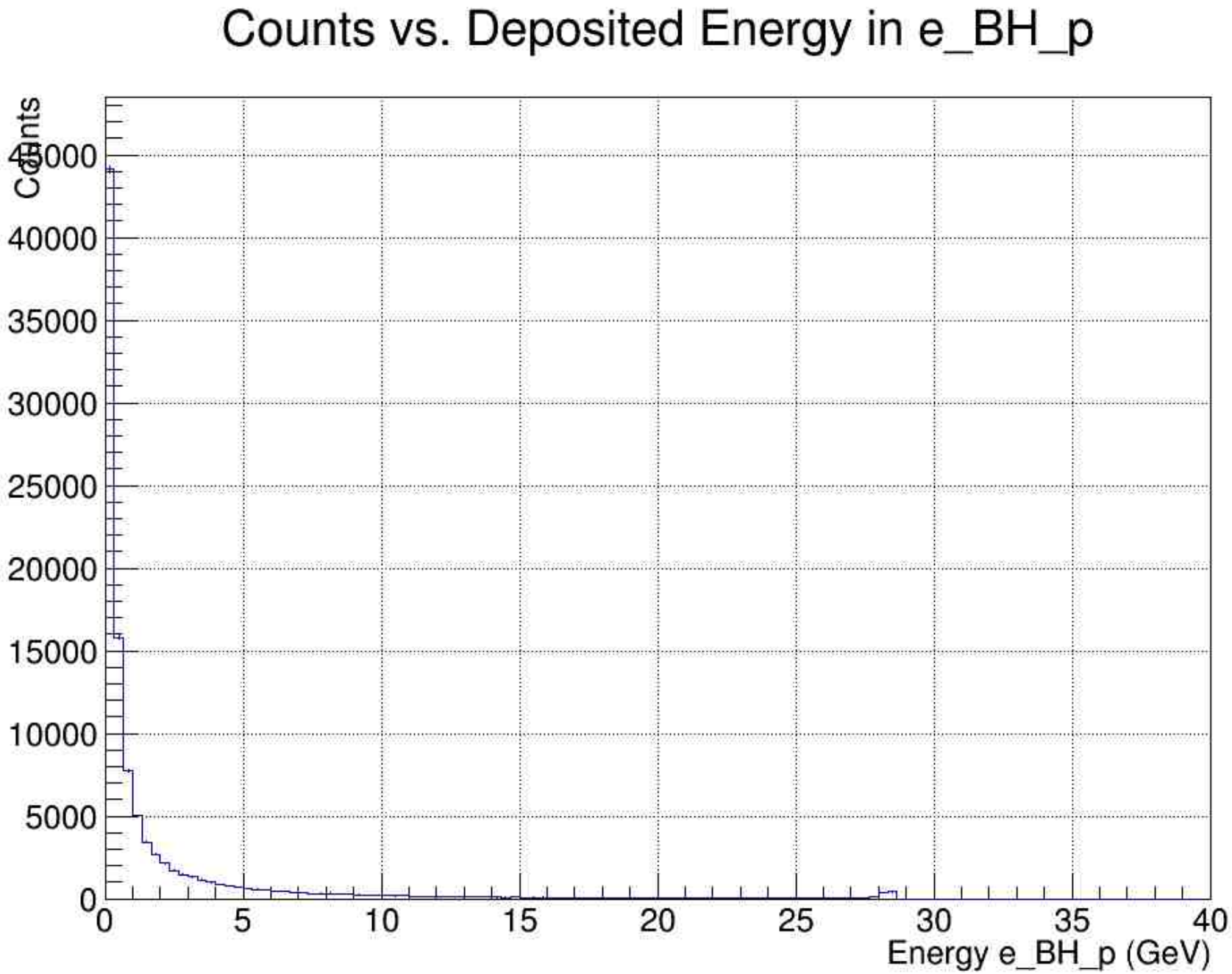
2.55 cm

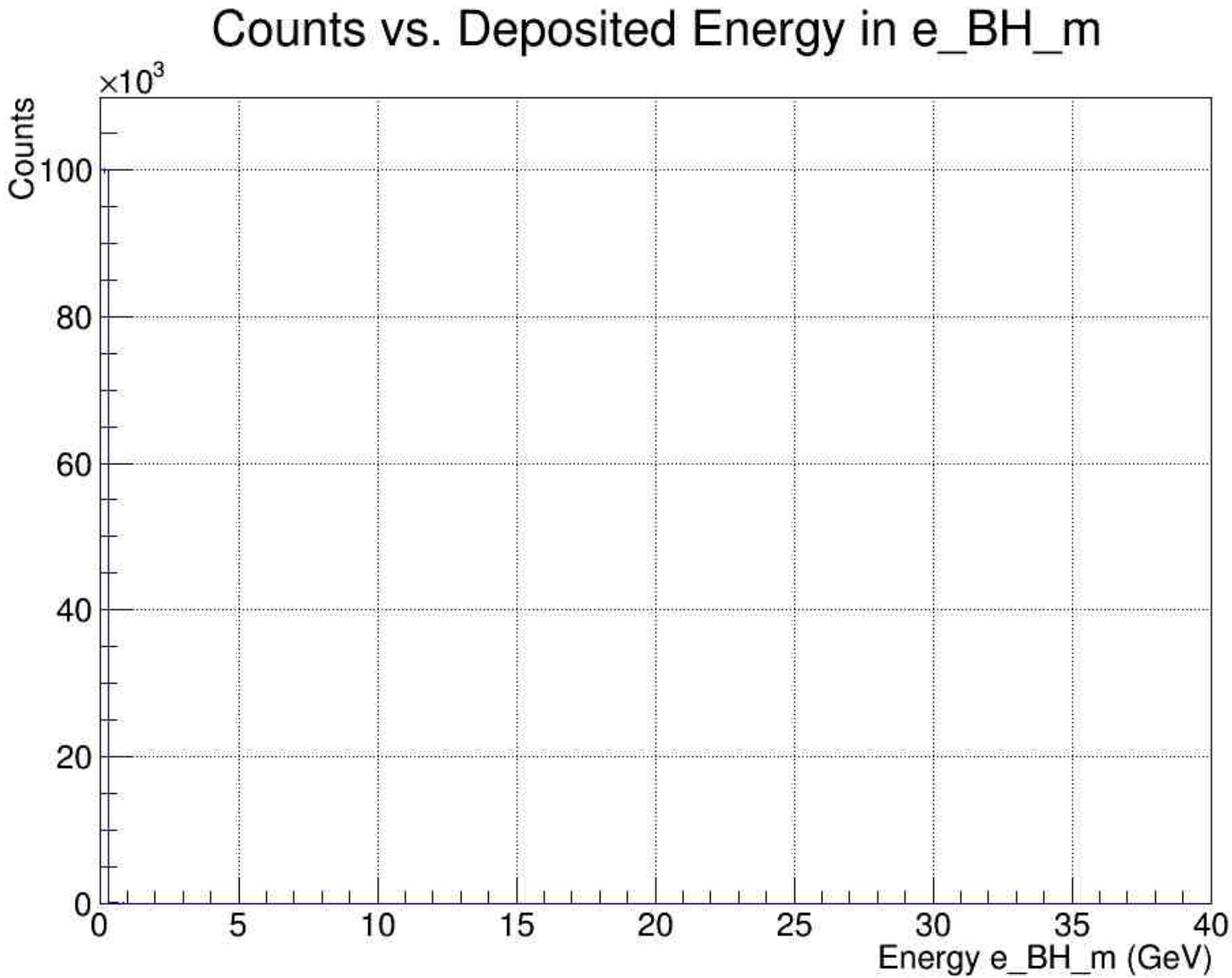

Counts vs. Deposited Energy in e
Counts
5000
4000
3000
2000
1000
0
0
5
10
15
20
25
30
35
40
Energy e (GeV)

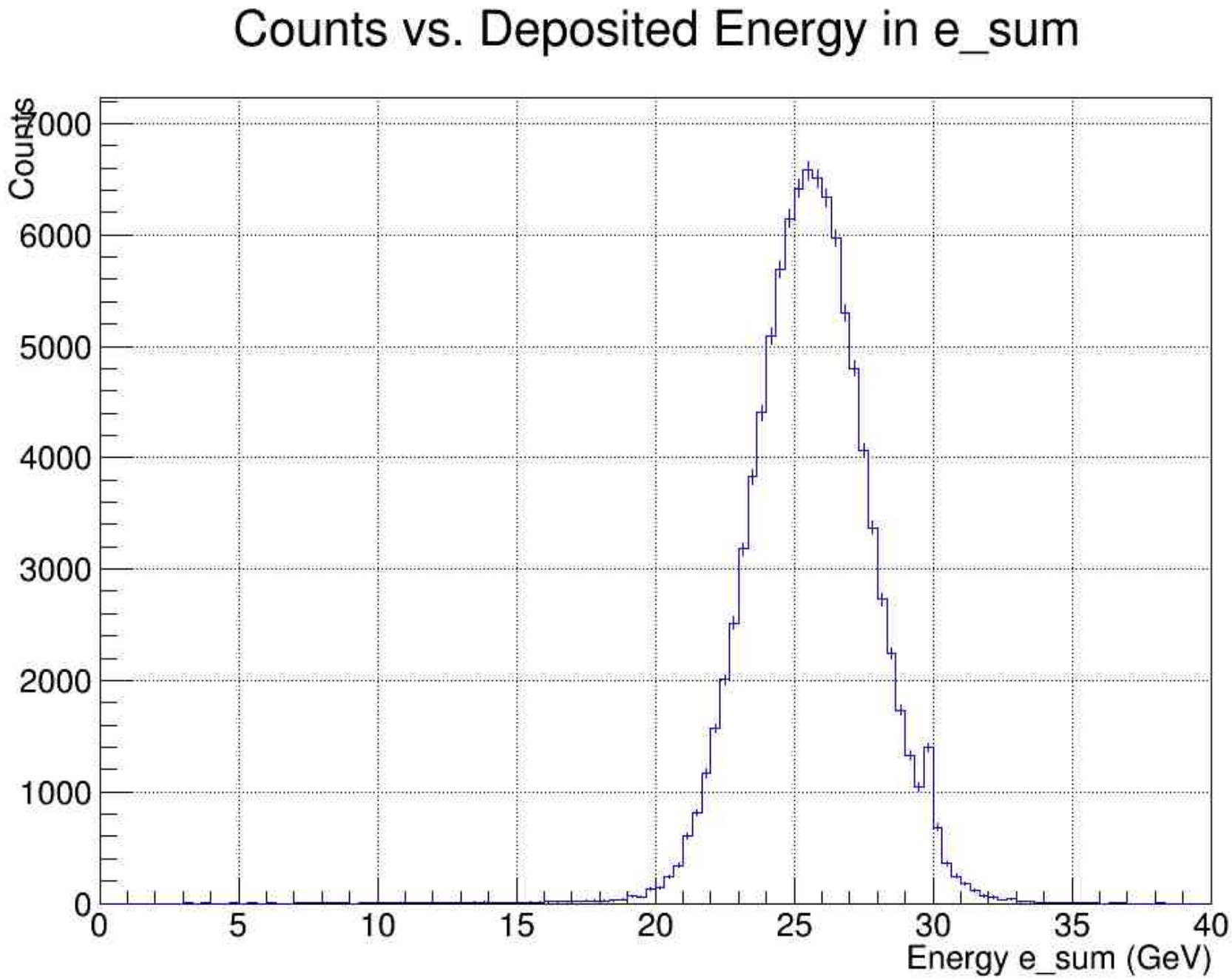

Counts vs. Deposited Energy in e_FR_p
Counts
50000
40000
30000
20000
10000
0
0
5
10
15
20
25
30
35
40
Energy e_FR_p (GeV)


Counts vs. Deposited Energy in e_FR_m
×10^3
Counts
100
80
60
40
20
0
0
5
10
15
20
25
30
35
40
Energy e_FR_m (GeV)


Counts vs. Deposited Energy in e_BH1
Counts
60000
50000
40000
30000
20000
10000
0
0
5
10
15
20
25
30
35
40
Energy e_BH1 (GeV)


Counts vs. Deposited Energy in e_BH_p
Counts
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
0
5
10
15
20
25
30
35
40
Energy e_BH_p (GeV)


Counts vs. Deposited Energy in e_BH_m
×10^3
Counts
100
80
60
40
20
0
0
5
10
15
20
25
30
35
40
Energy e_BH_m (GeV)


Counts vs. Deposited Energy in e_sum
Counts
7000
6000
5000
4000
3000
2000
1000
0
0
5
10
15
20
25
30
35
40
Energy e_sum (GeV)